Machine Shop
Building 83 – Pittsburgh

- *The Machine Shop is an R&D support function at NETL*
- *The machine shop is staffed by specialist technical site-support contract employees*

The machine shop in Pittsburgh comprises various machining tools that are used to support all the research conducted at NETL Pittsburgh.

The machinists work from blue-prints that are designed by NETL researchers, assist in the design working with NETL researchers, or devise and create the rough drawings based on discussions with the NETL research staff.

Some of the machines utilized in the shop include:

- Several metal lathes
- Drill Presses
- Milling Machines
- Band Saws
- Metal sheers
- MIG welder
- TIG welder
- Arc welder
- Metal brakes
- Grinders
- Sanders

Hydrogen Testing Research Facility
Building 83 -- Pittsburgh

- *The Hydrogen Testing Research Facility is an R&D support function at NETL*
- *The research is lead by a team of Federal employees and supported by both professional and technical site-support contract employees*

The objective of the research conducted in the HTR Facility is to investigate, evaluate, and validate hydrogen separation membranes and materials at realistic conditions in order to enhance hydrogen production at lower costs. Of interest are robust hydrogen separation membranes that are suitable for the rapid, selective removal of hydrogen from various gas streams, while the membranes remain stable and resistant to chemical impurities such as sulfur.

Key areas manned by the site support contractor for this research include:

- Hydrogen Membrane Test (HMT) Units--Research is primarily conducted using three continuous, steady-state, bench-scale HMT units. These units provide the capability of high-pressure, high-temperature hydrogen membrane flux measurements at conditions of up to 1000 psi at 900ºC. The units can accommodate membrane sizes up to one inch in diameter and up to six inches in length in both disk and tubular configurations, with process gas flow rates of about 1000 sccm. In addition, the HMT units have the flexibility to be used for both membrane separation testing and membrane reactor testing. The units often run 24 hours a day, but are generally only manned for a standard 8-hour daylight shift.

- Membrane Screening System (MSS)--A laboratory, batch MSS is used for rapid, unsteady-state analysis of membrane permeation under different environments. For example, it allows for short-term, low-pressure testing of membrane materials with different sulfur-containing gas mixtures at varying temperatures.

- Membrane Fabrication--Membrane fabrication equipment utilized includes high-temperature, controlled-atmosphere furnaces (used for material synthesis as well as brazing), precision TIG welder, presses, and cold plasma sputter coaters.

Computational Chemistry Research Facility
Building 94 -- Pittsburgh

- *The Computational Chemistry Research Facility is an R&D support function at NETL*
- *The computational chemistry effort is lead by a team of Federal employees and supported by professional and technical site-support contract employees*

The objective of the research conducted in the computational chemistry group is to investigate based on computational chemistry methods spanning from the quantum mechanical, atomic and molecular levels to the mesoscale level the energetic, structural, dynamic and transport properties of atomic and molecular systems involved in chemical and physical processes representative for NETL mission.

Key areas for site support include:

- Prediction of the macroscopic transport and adsorption selectivity of nanoporous materials. The predictions are performed by connecting the atomistic time and length scales through the use of classical molecular dynamics, Monte Carlo and quantum mechanical simulations, with the macroscopic scales of the actual chemical processes where these materials are used.

- Determining theoretical values of reaction energies, activation energies, transition states, frequencies, rates of reaction and other parameters for reactions using post-Hartree Fock methods including spin polarized Moller Plesset Perturbation Theory and Coupled Cluster as well as plane wave Density Functional Theory.

- Prediction of the catalytic properties of metals, alloys and insulating systems interacting with gas phase systems based on plane-wave Density Functional Theory methods. Evaluation of the structural, energetic and kinetic data for heterogeneous gas/surface systems using methods such as Nudged Elastic Band calculations, LST/QST methods, and kinetic Monte Carlo approaches.

- Prediction of the swelling properties of polymer systems by combined quantum mechanical/statistical mechanics models.

- Computational chemistry team will also interface with experimentalists at NETL, will establish collaborations with academic partners at nearby universities, make presentations at scientific meetings and publish results in peer-reviewed journals.

- Other responsibilities are related to maintenance of computational facilities including selection and acquisition of Linux computer clusters (several hundreds of processors in size), optimization of inter-node communication systems (Myrinet, Gigabit), installation and maintenance of software, installation of specific libraries for cluster administration and parallelization (MPI), administration of queuing system (PBS), and oversight of electrical and cooling functions for computer facilities.

Analytical Laboratories
Building 94 -- Pittsburgh

- *The Analytical Laboratories are an R&D support function at NETL*
- *The analytical laboratories in Pittsburgh are staffed by site-support contract employees*

The Analytical Laboratories are designed to perform accurate chemical analyses on various environmental and geological samples.

The analyses are performed using Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES) and Mercury Cold Vapor Atomic Absorption Spectroscopy (CVAA), in tandem with sample preparation techniques including microwave digestion, molten salt fusion, and mineral acid digestion. Wet chemical technique capabilities include pH, conductivity, oxidation-reduction potential (ORP), and titrations for acidity, alkalinity, and ferrous iron. Total inorganic carbon (TIC) can also be determined. These are normally requested on environmental samples.

A number of different research projects submit a diverse range of samples for metals and mercury analysis to the Inorganic Analysis Laboratory, including groundwater samples, experimental catalysts, brines, precious metal alloys, and coal combustion byproducts. The mercury analysis capabilities are used extensively in support of the Clean Air Technology team's 500 lb. unit and the NETL wastewater treatment facility. The expertise gained in the mercury sampling activities is now being put to use in the Carbon Dioxide Capture and Sequestration projects for trace metals analysis.

The instruments utilized for the preparation and analysis of samples at the analytical laboratory include: A Perkin Elmer Optima 3000 Inductively Coupled Plasma Spectrometer, a Perkin Elmer FIAS-100 Flow Injection Analysis System , a Cetac M-6000A Mercury Cold Vapor Atomic Absorption Spectrometer, a Milestone DMA-80 Direct Mercury Analyzer, an Anton Paar Multiwave Sample Preparation System, a Milestone Ethos Plus Microwave Labstation, a Blue M Rad-O-Glow Furnace, a CPI Mod Block Sample Digestion Station, two PC-controlled Leco TGA-601 Moisture and Ash Analyzer, a PC controlled Brinkmann 716 Titrino autotitrator, an Accumet AB15 pH meter for ORP, an Orion 960 autotitrator, a Mettler DL 25 titrator, an Orion model 150 conductivity meter, an UIC 5011 Coulometer for TIC, and a Cahn C-34 microbalance.

Wastewater Treatment Facility
Building 64 -- Pittsburgh

- *The Wastewater Treatment Facility is an ancillary support function at NETL*
- *The Wastewater Treatment Facility is staffed by site-support contract employees*

The NETL wastewater treatment facility (WWTF) collects laboratory- and process-generated wastewater in an equalization tank (approximately 35,000 gallons) and treats laboratory and process wastewater from all buildings on the R&D Plateau. The original purpose of the WWTF was to remove coal fines and oil. Presently, the WWTF discharge is regulated under the terms of an Industrial Sewer User Pretreatment permit granted to the site by the Pleasant Hills Authority. Local limits with which the WWTF treated effluent must comply are Free Cyanide, Phenolics, Mercury, Copper, pH, and Chloroform.

Prior to implementation of recent upgrades to the facility, treated effluent concentrations of mercury and free cyanides which exceeded the regulated concentrations occurred. Installation of various programmable process controllers allow the operators to maintain the quality of the treated effluent within the relatively narrow limits allowed under terms of the pretreatment permit.

Presently, additional operational needs assessments are being conducted to identify remaining shortcomings – resolution of which will require expenditure of funds for the purchase and installation of equipment, computerized operating system upgrading, and so forth.

Chemical Handling Facility
Building 92 – Pittsburgh

- *The Chemical Handling Facility is an ancillary support function at NETL*
- *The Chemical Handling Facility is staffed by site-support contract employees*

The Chemical Handling Facility (CHF) handles a multitude of tasks. Work includes collecting hazardous waste from satellite accumulation areas within laboratory or process areas. Wastes include solvents, metals, corrosive acids and bases, samples and residues from experiments. The CHF also handles non-hazardous waste such as wastewaters, flyash, coal residues, and contaminated personal protective equipment along with universal waste including spent fluorescent light bulbs and various lead, nickel cadmium, lithium hydride batteries for recycling.

Operations include collection and transport from laboratory operations and process areas to the CHF. CHF personnel ensure that waste are properly labeled, stored and packaged for shipment to approved hazardous and non-hazardous waste handling facilities. Some corrosive acidic and basic wastes are neutralized and discharged via Building 74, the Waste Water Treatment Facility. CHF personnel also prepare samples for analysis or for shipments to other research/university facilities along with maintaining a chemical inventory for new chemicals entering the NETL-PGH site.

Bulk Gas Storage
Building 65 -- Pittsburgh

- *The Bulk Gas Storage and Distribution systems are an R&D support function at NETL*
- *The bulk gas storage and distribution system is staffed by site-support contract employees.*

NETL dispenses nitrogen gas from storage tanks at their Pittsburgh facility for use in the laboratories and is located from the Bulk Gas Storage Facility between B-16 and B- 24. The NETL Pittsburgh site nitrogen system consists of 9, storage tanks, ambient air vaporizers, high pressure ASME storage vessels, and cryogenic, high-pressure, reciprocating pumps. The gaseous nitrogen system supports both high and low pressure needs and the distribution systems ends at the specific building isolation and check valves.

Cylinder Gas Receiving/Storage
Building 65 -- Pittsburgh

- *The Cylinder Gas Receiving/Storage Facility is an R&D support function at NETL*
- *The cylinder gas receiving/storage facility is staffed by site-support contract employees*

This Cylinder Gas Receiving/Storage facility provides procedures for the safe handling, storage, and distribution of compressed gas cylinders, utilized in the various projects at NETL, at the main storage area in Pittsburgh is located in Building 65 with usage destination areas located in Buildings 83, 84, 86, 94 and 99.

Advanced Instrumentation Laboratory
Building 84, Room 118 -- Pittsburgh

- *The Advanced Instrumentation Laboratory is an R&D support function at NETL*
- *The SAIS research is lead by a team of Federal employees and supported by both professional and technical site-support contract employees*

Surface Analysis and Imaging System (SAIS): NETL has analytical instrumentation that allows for full characterization of the first several atomic layers of a model catalyst system.

One instrument houses 6 distinct analytical capabilities and the ability to grow model catalysts in situ. Combining all of these capabilities into one single system allows researchers to study atomically clean surfaces which directly mimic the systems used in computational studies. These experimental capabilities include:

- Scanning Tunneling Microscopy
- Atomic Force Microscopy
- Low Energy Electron Diffraction
- X-ray Photo Electron Spectroscopy
- Ion Scattering Spectroscopy
- Auger Electron Spectroscopy
- *In Situ* Triple Source E-beam Evaporator

In addition, other analytical capabilities at NETL that are typically utilized for catalyst studies but located in other locations at NETL Pittsburgh include:

- Thermogravimetric Analysis
- Pulse Mass Analyzer
- Scanning Electron Microscopy
- Catalytic Reactor Systems
- In situ Infrared and Raman
- X-ray Diffaction
- Chemisorption and Pore Analyzer
- X-ray Photoelectron Spectroscopy with Reaction Cell

CO_2 Membrane Research
Building 84 – Pittsburgh

- *CO2 Membrane Research is an R&D support function at NETL*
- *The CO_2 membrane research is lead by a team of Federal employees and supported by both professional and technical site-support contract employees*

This research is aimed at developing robust membranes capable of selective CO_2 removal in reducing environments, such as in IGCC power plant fuel gas.

One current research focus is on a class of salts known as ionic liquids. Certain ionic liquids have high solubility for CO_2 compared to H_2 and other light gases, greater diffusivities than polymers, and are stable to temperatures above 200 °C. These characteristics lead to the conclusion that ionic liquids have the potential to form the basis for a new and superior class of CO_2 selective membranes. Another area of focus is on polymers which dissolve readily in CO_2. These polymers have high molecular affinity for CO_2 and, as a result, are promising candidates for membrane materials.

NETL researchers incorporate the ionic liquids into commercially available supports and fabricate polymer films in order to examine the performance of resulting membranes and determine whether or not particular candidates meet gas separation performance objectives. Beyond simply meeting high performance goals, the membranes are expected to perform at high temperatures in the presence of trace contaminants such as H_2S. Current testing includes experiments at temperatures above 300 °C and in the presence of a variety of contaminants.

Library
Building 84, Room 110 – Pittsburgh

- *The Library is an ancillary support function at NETL*
- *The Library facility is staffed by site-support contract employees.*

The NETL Library System is composed of a library in B2 Room 30 in Morgantown, a library in B84 Room 110 in Pittsburgh and a library in B1 Room 219 in Albany. The library system houses a large collection of government reports in both microfiche and paper copy, journal subscriptions both online and in paper format, reference material and publications in many fields of energy research and related fields.

The NETL Library System provides these services:

- Literature searching
- Citation searching
- ILL (Interlibrary Loans)
- Training on Information Retrieval
- Reference Questions
- General Searching for Information
- Assist with purchasing of books and reports
- Photo duplication of articles
- Microfiche copying of reports
- Assist with obtaining copies of theses
- Obtaining purchasing information on publications or subscriptions
- Distribution of electronic subscriptions
- Outreach requests to the public
- Other services as requested

Field Work
Building 84 -- Pittsburgh

- *Field Work Research is an R&D support function at NETL*
- *These activities are federally directed and are supported by contractor and subcontractor staff. Contractor and subcontractor personnel perform laboratory analyses, participate in field trips, analyze field data, and prepare manuscripts*

NETL uses an array of innovative laboratory techniques and field methods to detect and monitor fugitive emissions of CO_2 stored in geologic formations. By providing an accurate accounting of stored CO_2 and a high level of confidence that the CO_2 will permanently remain in storage, these efforts can help ensure the technical soundness and economic viability of carbon sequestration, a technology that is critical to meeting the national goal of reduced greenhouse gas emissions. Successful research to establish the stability and integrity of host formations will help developers of sequestration projects secure permits and emissions reduction credits, while preventing damage to ecosystems and ensuring public health and safety.

To identify possible CO_2 migration pathways, NETL scientists are investigating surface and near-surface characteristics by combining seismic surveys, satellite and aerial photography with remote sensing, ground-penetrating radar, and ground-based measurements. In cooperation with Regional Sequestration Partnerships, long- and short-term CO_2 monitoring is being conducted at depleted oil wells, saline aquifers, and coal-bed methane test sites.

A novel technique NETL used to monitor sequestered CO_2 is to add chemically inert perfluorocarbon tracer compounds to the CO_2 stream being sequestered, and then detect any resulting tracer emissions in soil-gas at extremely low concentrations. NETL developed the protocol for tracer detection and quantification, the soil sampling pump, and several sampling systems. Other NETL-developed techniques are capable of monitoring fugitive emissions of non-CO_2 greenhouse gases such as methane.

Occupational Health Unit
Building 58, Room 119 -- Pittsburgh

- *The Occupational Health Unit is an ancillary support function at NETL*
- *The OHU is staffed by site-support contract nurses*

The Pittsburgh Occupational Health Unit (OHU) is located in Building 58, Room 119. The Occupational Health Units provide medical, occupational health, and wellness services to NETL employees.

Medical Services

Non-emergency and emergency First-aid
Cardiopulmonary resuscitation
Automated External Defibrillator (AED)
Initiate Workers' Compensation paperwork
Medical Doctor on site one day a week

Occupational Health Services

NETL employees, whose job tasks place them at risk for routine exposure to hazards, are required to complete a medical surveillance (mandatory) health evaluation. These evaluations are offered annually based on current and/or previous job exposures. All other NETL employees are offered a voluntary health evaluation (annually for age 45 and over; biennially for under age 45) on a space available basis. Health evaluations include medical history (past and present), fasting blood work, blood pressure check, EKG, hearing test, vision test, pulmonary test, urinalysis, and medical examination by the on-site physician.

Wellness Services

The OHU offers health programs such as Weight Watchers, smoking cessation, blood pressure and blood sugar monitoring, flu clinic, foreign travel care, employee counseling, and educational materials.

Fitness Center
Building 167 – Pittsburgh

- *The Fitness Center is an ancillary support function at NETL*
- *The fitness center is staffed by site-support contract employees*

The fitness center provides a variety of cardiovascular and weight equipment. Along with the equipment, programs are offered to improve the health of employees. The programs offer development and implementation of fitness and health programs that provide employees the opportunity to enhance and maintain healthy lifestyles. Services will include individual and group exercise programs to promote cardiovascular conditioning, muscular strength, endurance, and flexibility; weight management, nutrition, and smoking cessation programs to help encourage positive lifestyles changes; and health education programs to provide the opportunity, motivation, and tools for self-improvement. All of the programs offered are designed to meet employee's needs and interests.

Day Care Center
Building 925 - Pittsburgh

- *The Day Care Center is an ancillary support function at NETL*
- *The Day Care Center is staffed by site-support contract employees.*

NETL has on-site, fee based day care facilities at both the Morgantown and Pittsburgh locations.

They are state-of-the-art facilities that are completely designed for the needs of children and include:

- An educational curriculum that engages all 5 senses and the most important sense, the sense of *FUN*
- An early Childhood program and the School-Age Program
- Music, creative movement, really messy arts and crafts
- Room to run, climb and explore
- Really fun field trips